Lawrence Livermore National Laboratory

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Predictive Science Panel Unclassified Report

LLNL Meeting

October 9–11, 2012

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Predictive Science Panel

LLNL Meeting, 9-11 October 2012

Unclassified Report

The Predictive Science Panel (PSP) held its annual meeting at LLNL on 9-11 October 2012. The meeting included a half day of overview presentations, followed by 1 ½ days of "deep dive" sessions:

- NBI Reconfiguration
- Transport Algorithms
- Ignition Prediction
- Safety and Surety

There was also a discussion of LANL's feedback on the PSP's March 2012 report.

This document provides an unclassified summary of the Panel's observations. Significantly more detail is provided in the PSP's classified report.

A number of significant accomplishments were described. The Panel was impressed by the completion of the 2012 Level 1 milestone, including the predictions for an upcoming experiment. While these predictions will be refined before the experiment, they represent an important test of predictive capability. The Panel looks forward to hearing about the comparisons of these predictions with the experimental results in a future meeting, and recommends that the effects of model uncertainties be addressed.

The Panel appreciated the description of recent Pu experiments and thinks that good progress is being made in this important area. The Panel was pleased to see the progress in bringing Sequoia to full capability in the face of challenging hardware issues. The initial performance data are impressive.

There was significant discussion of NNSA's proposal to reconfigure the NBI milestones and Predictive Capability Framework pegposts, bringing a Level 1 milestone forward from 2018 to 2014. In the Panel's opinion, there is no technical justification for doing this. The original order of the milestones/pegposts remains logical, with the Level 1 milestone in 2016 a clear next major step. The Panel agrees with the proposal that a 2014 pegpost could consist of a small number of Level 2 milestones as a stepping stone to the 2018 pegpost/Level 1 milestone. The Panel believes there would not be enough progress, due to time and resource constraints, to justify a Level 1 milestone in 2014.

The Panel is heartened to see the WCI efforts towards understanding why ignition was not achieved during the National Ignition Campaign and proposing experiments that will elucidate this. The Panel recommends that these activities be given the full support of LLNL senior management. The current and proposed activities are aimed at high leverage issues that address the apparent limitations of predictive capability. Four primary activities were described: understanding the discrepancy between the apparent and actual drive on the capsule, developing a higher adiabat and lower convergence ratio platform, measuring hydro instability growth and developing alternate ablators. The Panel is concerned that there would not be enough NIF shots to make adequate progress on all four of these activities and recommends that priority be given to the first two, with the development of alternate ablators considered a lower priority. In the first activity, initial WCI experiments suggest that the drive seen by the capsule is consistent with the other observables, e.g. implosion velocity and bang time. It is essential that efforts be continued to validate this result and also to understand why the drive is not consistent with the simulations and Dante measurements. The "missing energy" needs to be understood.

The NIF laser is working exceedingly well, meeting or exceeding its specifications and providing unprecedented precision that will enable a wide variety of important HED experiments, both non-ignition and, hopefully, ignition in the future.

The Panel is concerned that the fact that ignition was not demonstrated during the National Ignition Campaign will be used to question the predictive capability required for the Stockpile Stewardship Program. While the Panel understands that the ignition effort represented a significant extrapolation from the previously validated conditions, this is a subtle argument that may be lost on those with less detailed knowledge, such as Congressional staff. LLNL and LANL need to develop a short and simple description of why the failure to achieve ignition to date does not undermine the Nation's predictive capability for the stockpile. As stated in the 90-day study of the Applications of Ignition, "a delay in achieving ignition will lead to a delay in advancing understanding that would be beneficial to both the ongoing stockpile warhead assessments and Life Extensions Program options," and "the impact of failing to attain thermonuclear ignition and burn in the laboratory after a number of years of focused effort would be significant." The Panel agrees with this assessment, hence the need for an ability to clearly articulate the difference between near-term and long-term impacts.

The Panel encourages LLNL to allow the use of beryllium in NIF experiments and implement Advanced Radiographic Capability as soon as possible. These two capabilities would significantly enhance the HED opportunities on the NIF.

The Panel very much appreciated the willingness of the working scientists to engage in technical discussions and honestly describe the issues of concern. The Panel thought the level of engagement was very helpful and encourages the scientists to continue to provide questions that they would like the Panel to consider in future meetings.